MEMORANDUM

TO: Mike Torpey, BP — March 20, 2003

FR: Frank Shuri, GAI

RE: MODIFICATIONS TO SURFACE WATER DESIGN — 013-1421-001.011

Background

In mid-2001, a conceptual-level design of the surface water control system for the BP Cherry Point Cogeneration Project was performed to establish initial stormwater routing and detention pond sizing. This study[1] was performed in accordance with the regulatory requirements and guidance at the time, and was included in the initial Energy Facility Site Evaluation Council (EFSEC) Application for Site Certification (Application).

Since this time, the Washington State Department of Ecology has developed a computer model, the Western Washington Hydrology Model version 2 (WWHM2), for designing detention ponds to satisfy the regulatory requirements for both flow control and water quality. Consequently, the affected portions of the surface water control system have been re-analyzed to determine if the detention pond sizes proposed in the EFSEC Application would change significantly.

In addition, there have been other, more minor changes to the surface water control system, primarily related to location and routing.

This memo presents the results of the revised analysis for the detention ponds and the layout of the surface water control facilities. The current layout is shown on Figures 1A (Construction) and 1B (Operations). Because the drainage areas and routing have been modified, the ditch flows presented in the initial EFSEC Application will also change. However, these flows have not been revised at this time.

The Western Washington Hydrology Model

The WWHM2 utilizes continuous simulation hydrology (i.e., overlapping rainfall events based on historical records), rather than a single peak event as the basis for hydrologic analysis. This is considered to more realistically simulate longer-duration, lower-intensity events in Western Washington.

The model also employs several modules for input of site geometry and conditions. The user is presented with a choice of surfaces, such as impervious, landscape-over-outwash, forest-over-till, etc.

[1] "Cherry Point Cogeneration Project Surface Water Management System Design Basis", Golder Associates Inc., December 2001, Project No. 013-1421.530

The model calculates the "pre-developed" runoff, which then serves as the upper limit for allowable flow from the "post-developed" condition. We have analyzed ground surface conditions both during construction and during operations, as described below. The results from WWHM2 are considered conservative, because they do not include the effects of Best Management Practices (BMPs) for erosion and sediment control, such as silt fences, sandbags, hay bales, etc., which have been proven to significantly improve water quality (and in some cases slow down runoff), and which are planned for use during construction of the Cherry Point Cogeneration Project.

WWHM2 then determines the required detention pond size based on flow control and water quality requirements. This is accomplished with an internal module that optimizes the pond size based on various combinations of pond area, orifice sizes, and orifice locations. Pond size can also be optimized manually by varying these parameters.

Analysis

The two areas requiring flow and water quality control, the main laydown areas (Drainage Area 6) and the Plant Site (Drainage Areas 4 and 5), were modeled separately using WWHM2. These areas are shown on Figures 1A and 1B.

The pre-developed runoff for both areas was determined using the wetland delineation current at the time of the re-analysis (Figure 3.4-1 "Impacted Wetlands Within Study Area", October 2002). Using this data, the pre-developed site is assumed to have two types of cover: wetland and upland. These conditions are considered to represent the pre-development state of the land, since the basic geology and slopes of the land do not appear to have been modified by development. Using the ground surface options available in WWHM2, wetlands were modeled as "saturated pasture" and uplands were modeled as "forest over till". The latter category was selected because the Bellingham Drift, which has a relatively low permeability, underlies the project site.

Post-developed conditions are the more stringent of either the construction phase or the operational phase. For Drainage Area 6, we understand that the entire area will be covered with a granular fill, and that this will be maintained into the indefinite future. Hence, only one analysis was performed for this area. The granular cover over Area 6 is expected to have a significant rainfall storage capacity and relatively high infiltration rate. However, vehicle traffic and other construction activities are expected to produce some degree of compaction, which could lower the permeability of this material. Because the borrow source for the granular soil has not been identified, and hence this material has not been tested, approximately 30% of Drainage Area 6 was modeled as "streets/parking" to reflect a high degree of compaction in heavily-trafficked areas, and the remainder was modeled as "landscaping over till" to reflect a lesser but still significant degree of compaction. This approach is considered conservative, as it likely underestimates the infiltration and storage capacity of the granular material under actual conditions.

For the plant site, there are two developed scenarios: construction and operation. Both scenarios were modeled to determine the governing case (i.e., which requires the larger pond). The construction scenario consists of parking and laydown areas. These were modeled similarly to the areas in Drainage Area 6, with the assumption that all of Drainage Area 5 (about 30% of the total area) would experience high traffic volumes and should be modeled as "streets/parking", while the plant site itself (Drainage Area 4) would experience moderate compaction and should be modeled as "landscaping over till". As above, this approach is considered conservative.

The operations scenario at the plant site is based on the layout provided in early August, 2002. The various surfaces were modeled as "impervious surfaces" (i.e., roofs), "streets/parking", and "landscaping" over both till and outwash soils. The switchyard area was modeled as "landscaping over outwash" soils, since a several foot thick layer of high-permeability gravel and sand will cover this area. Other soil surfaces were modeled as "landscaping over till". Laydown Area 4 was removed from the operational analysis, as we understand that this laydown area will be used only during construction and will be return to a natural condition when construction has been completed.

The input parameters used for this analysis are summarized in Table 1:

Table 1: Input Parameters for WWHM2 Analysis

Input Parameter	Drainage Area 6	Plant Site (Construction)	Plant Site (Operational)
Size of Site	31.8 acres	27.9 acres	22.5 acres
Pre-Developed Wetland	27.1 acres	11.3 acres	11.3 acres
Pre-Developed Upland	4.7 acres	16.6 acres	11.2 acres
Post-Developed Impervious	0 acres	0 acres	4.0 acres
Post-Developed Streets/Parking	9.1 acres	6.6 acres	4.3 acres
Post Developed Landscape Over Till	22.7 acres	21.3 acres	8.7 acres
Post Developed Landscape Over Outwash	0 acres	0 acres	5.5 acres

Results

The three scenarios described above were analyzed with WWHM2, and preliminary pond sizes were determined. The depth of the ponds was assumed to be 6 feet, as was done for the flow-control analysis in the EFSEC Application. Based the input parameters discussed above, our understanding of WWHM2, and the previous results (based on a different type of runoff model) described in the EFSEC Application, these estimates are believed to be reasonable to somewhat conservative. However, future revisions to the model, or differing regulatory interpretations, could change these results.

The results of this study are summarized in Table 2. Required pond areas are at the ground surface, and include the effects of 3H:1V side slopes. The areas from the existing EFSEC design are included for comparison.

Table 2. Required Pond Areas

Scenario	WWHM2 Area	EFSEC Permit Application Area	WWHM / EFSEC Ratio
Drainage Area 6	1.3 acres	0.6 acres	2.2
Plant Site Construction	1.3 acres	1.0 acres	1.2
Plant Site Operational	0.8 acres	1.0 acres	0.8

The Water Quality Module was also run to determine the required "dead space" to meet water quality (i.e., turbidity) requirements. This dead space will be provided by additional depth in the pond, below the lowest orifice. The water quality volume required for Drainage Area 6 is 1.7 acre-feet, increasing the pond depth by approximately 2 feet. The water quality volume required for the Plant Site (construction scenario) is 1.4 ac-ft, requiring approximately 1.5 feet of additional depth. Excavating the ponds to a depth of 8 feet will accommodate these additional depths, which is the same approach used in the EFSEC Application, and will therefore not affect the required pond areas.

The revised detention ponds calculated using WWHM2 are shown on Figures 1A and 1B.

Other Modifications

Other modifications that have been made to the surface water management system since the EFSEC Application (June, 2002) have been incorporated on Figures 1A and 1B, and include the following:

- Detention Pond 1 has been moved to the south of Grandview Road.
- Flow along Ditch T-1 (south of Grandview Road) is no longer diverted, but discharges under Grandview Road in its current location.
- The footprint of Laydown Area 4 has been reduced, and associated diversion and collection ditches modified, to preserve existing wetlands.
- The footprint of the plant site has been reduced.
- Runoff from Drainage Area 2 is now discharged north of Grandview Road in its current location, rather than being diverted through the Duck Ponds.
- Laydown Area 4 and the northern portions of Laydown Area 6 and the Construction Trailer Parking Area will be restored to wetlands. Control weirs will be installed to regulate flow into these areas.
- The outflow from Detention Pond 1 will discharge through a buried pipe that proceeds west under Blaine Road then north under Grandview Road to the wetlands area.

It is recognized that since the re-analysis of the detention ponds was performed, other changes have been made, such as moving Detention Pond 1 into the plant area footprint. The changes that we are aware of will affect routing and location of ditches, but are not expected to significantly impact the pond sizes shown on the attached drawings. It is expected that detention pond sizing and other features of the surface water control system will be finalized during the detailed design process, when other features of the facility have been firmly established.

C:\DATA\FSS\0131421 BP Cherry Pt\x001\Modification Summmary 2.doc

FIGURES